SR-C851T00

Instruction Sheet "B"

VHF/FM
BUSINESS, INDUSTRIAL
RADIOTELEPHONE

Standard Communications Corp.

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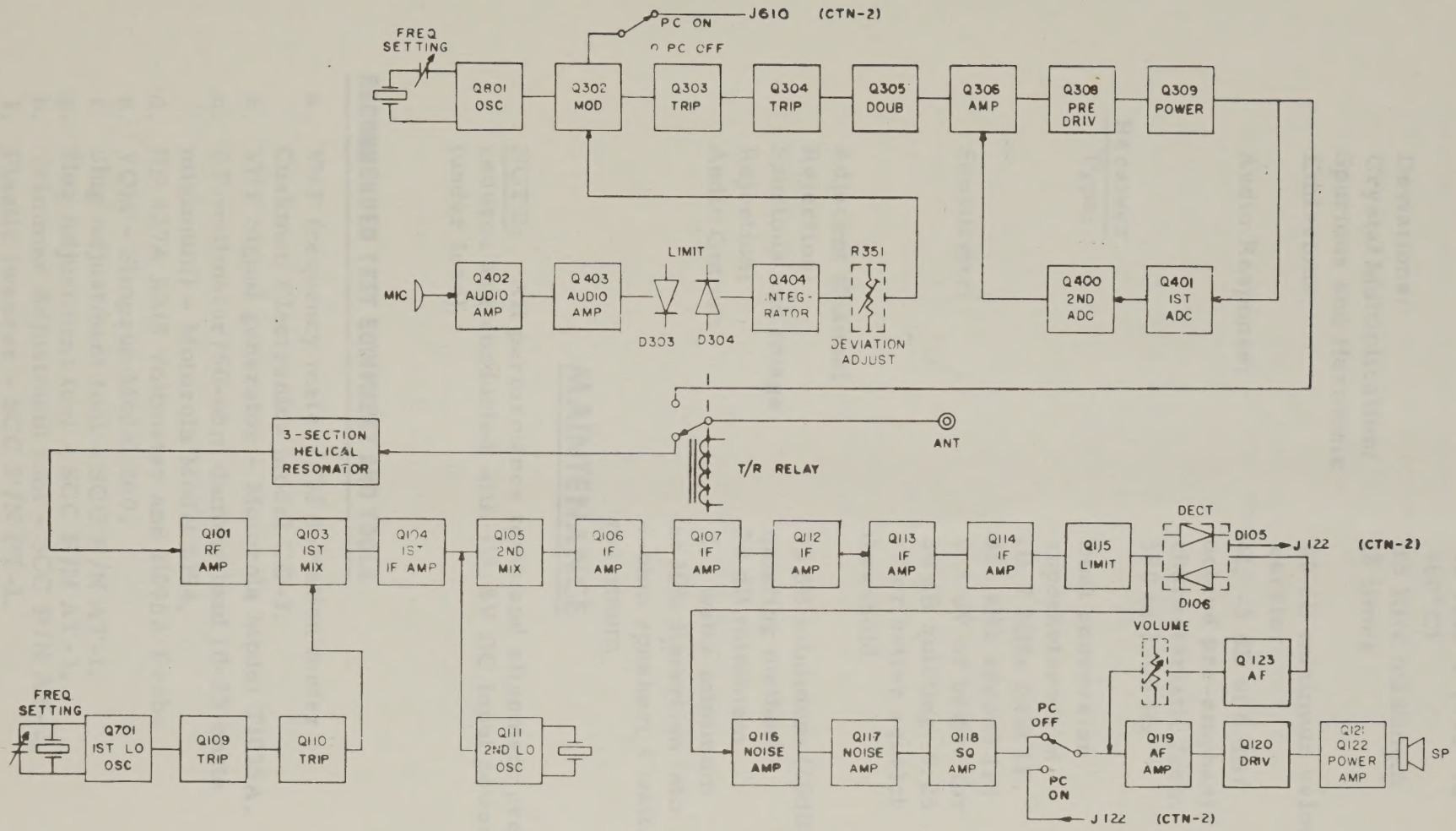
GENERAL INFORMATION

The STANDARD COMMUNICATIONS CORP. Model 851TOO VHF/FM Business / Industrial Radiotelephone provides 12 channel operation between 148 and 174 MHz. The Model 851TOO is FCC type approved for use under Parts 21, 89, 91 and 93, and is designed to operate from a 12-volt DC system. The unit is enclosed in a splash-proof, weather resistant, aluminum case for environmental protection. Provision is also included for installation of an optional Model TN2 Private Channel Tone Coded Squelch, or Model TD-1 (Bell System) or TD-2 (RCC System) Telephone Decoder. These units were previously designated ATR-1/2 Telephone Decoders. This instruction sheet is in two parts. Sheet "B" provides general information, maintenance data and electrical parts list. Sheet "A" provides schematic diagrams and circuit board layouts.

SPECIFICATIONS

General

Frequency Range:	148 to 174 MHz
Number of Channels:	1
Power Requirements:	12.0 to 16.0V DC (negative ground only): Maximum battery drain is 0.3 ampere on standby, 1.2 ampere receive (maximum audio), and 6 amperes transmit
Semiconductor Complement:	36 transistors, 15 diodes dynamic speaker in separate enclosure
Accessories Supplied:	Dynamic microphone. Dynamic speaker in separate enclosure. Line filter.
Dimensions:	2-1/2" high x 6-7/8" wide x 11" deep (less mounting bracket, knobs, and connectors)
Weight:	5 lbs maximum



Block Diagram

Transmitter

RF Power Output:	25 watts into 50-ohm load at 13.8V DC
Frequency Stability:	±0.0005% from -22° to +140°F (-30° to +60°C)
Deviations:	±5 KHz maximum
Crystal Multiplication:	18 times
Spurious and Harmonic Emissions:	60 dB minimum below carrier
Audio Response:	+1, -3 dB of 6 dB/ octave pre-emphasis characteristic from 350 to 2500 Hz

Receiver

Type:	Dual conversion superheterodyne (11.7 MHz first IF, 455 kHz second IF)
Sensitivity:	0.5 uV or better for 20 dB quieting; 0.25 uV or better squelch threshold
Adjacent Channel Rejection:	90 dB minimum (20dB quieting method)
Spurious and Image Rejection:	70 dB minimum
Audio Output:	2.5 watts minimum at 10% distortion into 4-ohm speaker; 4 watts maximum

MAINTENANCE

NOTE: All performance tests and alignment procedures are conducted with +13.8V DC input power (under load).

RECOMMENDED TEST EQUIPMENT AND TOOLS

a. VHF frequency meter/FM deviation meter - Cushman Electronics Model CE-3.
b. VHF Signal generator - Motorola Model T1035A.
c. RF wattmeter/50-ohm dummy load (0-25 watts minimum) - Motorola Model 6154.
d. HP 427A RMS Voltmeter and 11096A Probe
e. VOM - Simpson Model 260.
f. Slug Adjustment tool - SCC P/N AT-1.
g. Slug Adjustment tool - SCC P/N AT-3.
h. Trimmer Adjustment tool - SCC P/N AT-2.
i. Plastic tweezer - SCC P/N PT-1.

TROUBLESHOOTING

Signal Tracing: Conventional signal tracing techniques can be utilized to isolate a fault within a particular circuit of the receiver or transmitter once an abnormal indication is observed at a test receptacle pin. An oscilloscope provides the simplest method of such signal tracing, as a circuit malfunction will be immediately apparent.

Test Receptacles. The receiver (RT) and transmitter (TT) receptacles permit selected circuit parameters within the unit to be measured as an aid in troubleshooting, or monitored during alignment to provide an indication when the individual circuits are properly tuned. Refer to Sheet A for test receptacle functions and nominal voltage measurements.

Voltage and Resistance Measurements: Once the malfunction has been isolated to a particular circuit, voltage and resistance measurements may be used to isolate a defective component. Reference to the Schematic Diagram and Circuit Board Layout will assist in this operation.

PERFORMANCE TESTS

Transmitter. Connect the radiotelephone to a suitable +13.8V DC (negative ground) source and connect an RF wattmeter/50-ohm dummy load to the ANT receptacle. Connect a precision VHF frequency meter to indicate the transmitter output frequency, and an FM deviation meter. Check the transmitter as follows:

CAUTION: NEVER KEY THE TRANSMITTER UNLESS AN ANTENNA, OR 50-OHM DUMMY LOAD IS CONNECTED TO THE ANT. RECEPTACLE.

a. Key the transmitter and check that the power output on the wattmeter is at least 20 watts. Check that the frequency meter indicates within 0.0005% (±750 Hz), and whistle into the microphone to check that the deviation is within ±5 kHz.

b. If the required performance cannot be obtained, perform the transmitter alignment procedures.

Receiver: Disconnect the wattmeter from the ANT receptacle and connect the RF output of a precision VHF signal generator in its place. Connect a VTVM (set to read AC volts) between pin RT7 and ground. Check the receiver 20 dB quieting and squelch sensitivities as follows:

a. Adjust the SQL control for maximum speaker noise and with no signal input note the "noise voltage" reading on the VTVM. Adjust the signal generator to the correct frequency and adjust the amplitude until the reading on the VTVM drops to 1/10th of the reading (20 dB decrease) noted previously. The signal generator output amplitude should be 0.5 uV maximum.

b. With no signal input, adjust the SQL control until speaker noise just cuts out (squelch threshold), then apply signal and adjust signal generator amplitude until "noise" is heard: The signal generator output amplitude should be 0.25 uV maximum.

c. If the required performance cannot be obtained, perform the receiver alignment procedures.

ALIGNMENT AND ADJUSTMENT

General: Remove the three screws and washers at the front of the case, and the six screws at the rear. Carefully slide the case back to remove the radiotelephone assembly.

CAUTION: EXERCISE EXTREME CARE IN ADJUSTING THE SLUG-TUNED INDUCTORS. THE CORES ARE EXTREMELY BRITTLE AND ARE SECURED WITH PAINT. APPLY A SMALL DROP OF ACETONE TO SOFTEN THE PAINT PRIOR TO MAKING ADJUSTMENTS, AND USE AN SCC P/N AT-1 OR AT-3 ADJUSTMENT TOOL AS APPROPRIATE.

WHEN ADJUSTING AIR WOUND INDUCTORS, USE AN SCC P/N PT-1 PLASTIC TWEEZER, SPREADING THE TURNS TO INCREASE FREQUENCY, AND SQUEEZING TOGETHER TO DECREASE. MAKE ALL ADJUSTMENTS ALTERNATELY AND IN SMALL INCREMENTS AS INTERACTION EXISTS.

Power Connection. Connect the radiotelephone to a suitable +13.8V DC (negative ground) power source and apply power.

Receiver: Connect the IF output of a precision signal generator through a 0.01 uf capacitor at the collector of Q105. Connect a VTVM (set for a "zero center" reading on DC volts) between pin RT6 and ground. Align the receiver circuits as follows: (refer to Figures 1 and 3 for location):

a. Adjust the signal generator for an approximate 100 uV output at 455 kHz (±10 Hz). Using the appropriate adjustment tool, adjust the core in L117 until the VTVM indicates "zero center".

b. Disconnect the VTVM from RT6, and using an RF probe connect it to the emitter of Q110 (set the VTVM for 3.0 volts full scale). Using the appropriate adjustment tool, adjust the cores in L112 thru L115 for maximum response on the VTVM (2.5 volts or greater).

c. Disconnect the signal generator from Q105 and connect the RF output to the ANT receptacle. Disconnect the VTVM from Q110 and connect it between pin RT4 and ground (set for DC volts).

d. Adjust the signal generator for an approximate 10 uV output at the proper frequency and using the appropriate adjustment tool, adjust the cores in L102, L103, and L106, for maximum reading on the VTVM. Reduce the generator output as required to maintain an "on-scale" reading on the meter.

e. Repeat step "d", adjusting capacitors C951 thru C953, located on the side of the helical resonator.

f. Repeat step "d", sequentially adjusting the cores in L107 thru L111.

g. Connect the VHF frequency meter to indicate the signal generator frequency and adjust the generator output for 10 uV at the exact input frequency. Connect the VTVM (set for a "zero center" reading on DC volts) between pin RT6 and ground. Adjust trimmer capacitor, C707, until the VTVM indicates "zero center."

h. Following completion of the receiver alignment, recheck to verify the 20 dB quieting and squelch threshold sensitivities.

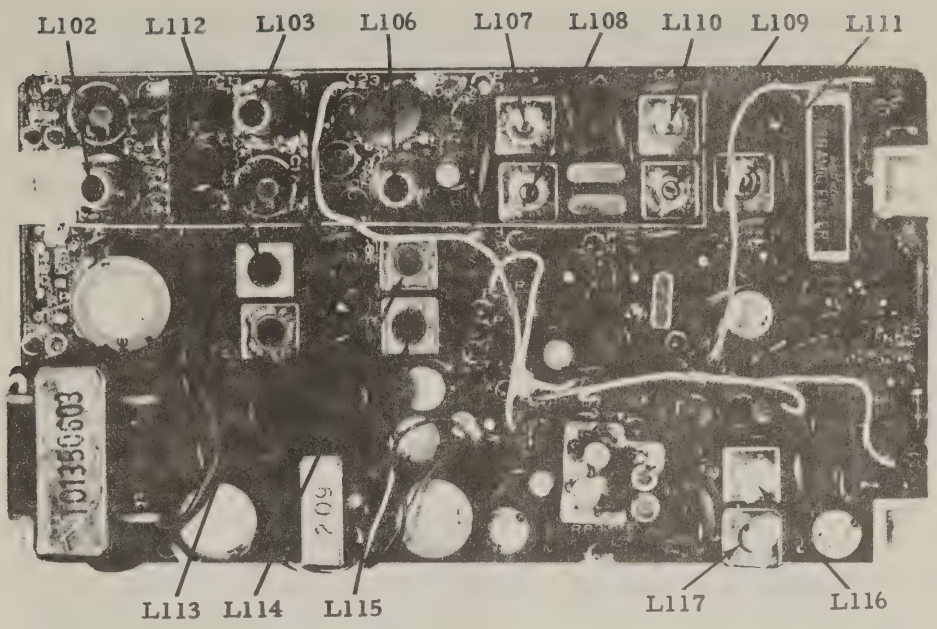


Fig. 1: Receiver Circuit Board

Transmitter: Connect the RF wattmeter/50-ohm dummy load to the ANT receptacle. Using the appropriate adjustment tool, adjust the transmitter RF stages in the following sequency to obtain maximum response on the appropriate meter. (refer to Figures 2 and 3 for location).

a. Connect the VTVM (set for +DC volts) between pin TT2 and ground; key the transmitter and adjust the cores in L302 and L303 for maximum response. Change the VTVM to pin TT3; key the transmitter and adjust the cores in L304 and L305 for maximum response. Change the VTVM to pin TT4; key the transmitter and carefully adjust the spacing between turns of L306 and L307 for maximum response.

b. Connect the VTVM (set for -DC volts) between pin TT5 and ground; key the transmitter and carefully adjust the spacing between turns of L308 and adjust C401 for maximum response.

c. Key the transmitter and carefully adjust the spacing between turns of L309 and L310, and adjust C402 for maximum response on the RF wattmeter.

d. Key the transmitter and adjust C501 for maximum response on the RF wattmeter.

e. Key the transmitter and adjust C502 thru C504 for maximum response on the RF wattmeter.

f. Key the transmitter and carefully adjust the spacing between turns of L312 thru L315, and adjust C407 for maximum response on the RF wattmeter.

g. Key the transmitter and readjust L304, L315 and C407 as required for maximum response on the RF wattmeter.

h. Connect the VHF Frequency Meter to indicate the exact transmitter frequency. Key the transmitter and adjust trimmer capacitor, C832, until the frequency meter indicates within ±250 Hz or less.

i. Connect the 1000 Hz audio output of the signal generator between pin RT1 and ground and set up the FM deviation meter. Adjust the audio output level to 30 mV.

j. Key the transmitter and adjust the IDC potentiometer, R351, to obtain a ±3.5 kHz deviation. Reduce the audio output to 8 mV and key the transmitter: Check that essentially full deviation is obtained. If the deviation at 8 mV is less than 2/3 of the deviation at 30 mV insufficient audio gain is indicated. Check voltage levels in the audio circuit, and transistors Q402 thru Q404.

l. Key the transmitter and readjust the audio output level to produce 2/3 of the rated deviation (approximately ±3 to 3.5 kHz). Increase the audio level 20 dB and key the transmitter: Check that the deviation does not exceed ±4.5 to 5 kHz.

m. Following completion of the transmitter alignment, recheck to verify the performance requirements.

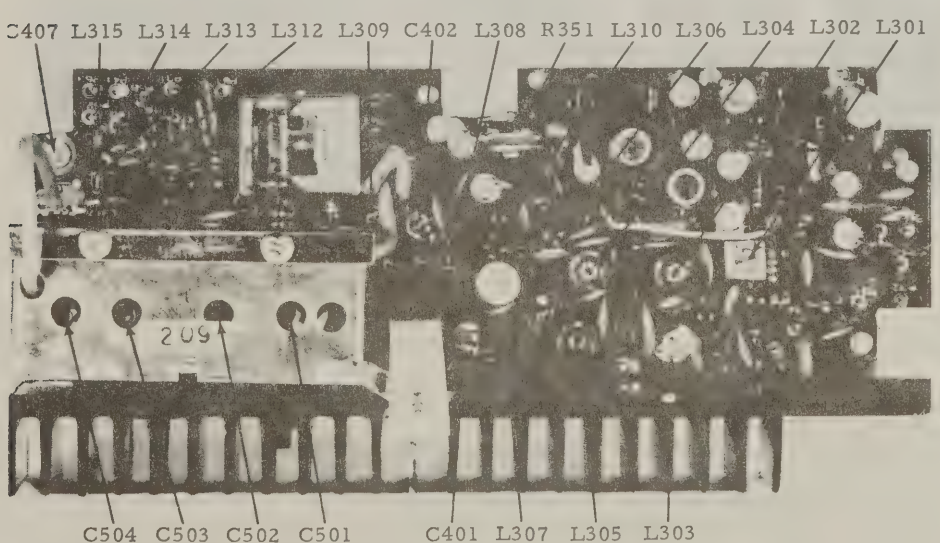


Fig. 2: Transmitter Circuit Board

CHANGING OPERATING FREQUENCIES

Changing operating frequencies involves changing the transmitter and receiver first local oscillator crystals, and may also require changing some components in the transmitter temperature compensation circuit. A large frequency excursion may also require realignment of the receiver and transmitter tuned circuits.

Temperature Compensation. The compensating network, G801, consists of a capacitor in series with a thermistor. The values of capacitors C855 thru C857, and C860, are selected to compensate the temperature/frequency variations of the crystals (see Table 1). Refer to the oscillator circuit board overlay for location. The crystals are temperature graded into four groups and color coded for identification (brown for G1; red for G2; orange for G3; and yellow for G4.

NOTE: Unless otherwise indicated the standard temperature compensating circuit is configured for G3 crystals.

Ordering Crystals. When ordering crystals, specify the desired operating frequency, not the fundamental crystal frequency. The transmitter crystal is a SCC type TX1-G* (asterisk represents either G1, G2, G3 or G4, depending upon the crystal group desired). The receiver crystal is a SCC type RX1. The receiver crystals are not temperature compensated.

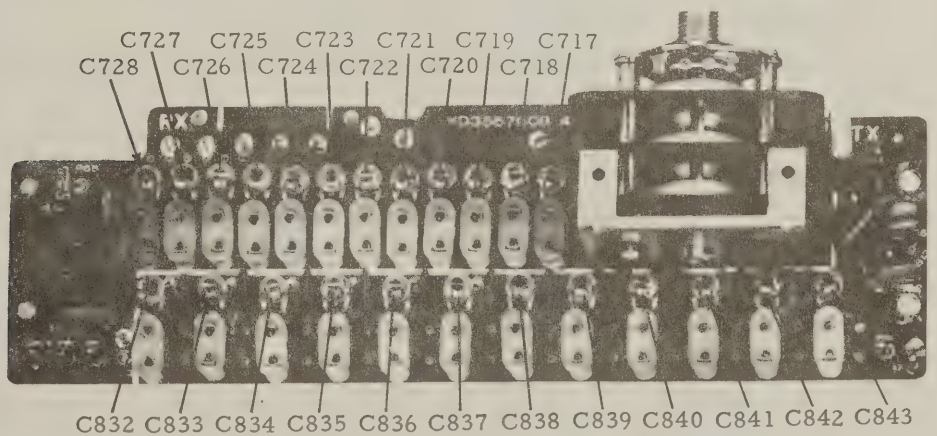


Fig. 3: Crystal Oscillator Circuit Board

REF. DESIG. / CRYSTAL GROUP	C856 C860	C857	C858
G1 (BROWN)		DF3651001 50pf;mica	DF3651001 50pf;mica
G2 (RED)	DD1205005 5pf;N4250	DD1550008 50pf;N750	DD1550008 50pf;N750
G3 (ORANGE)	DD1205005 5pf;N4250 (2 in parallel)	DD1550008 50pf;N750	DD1550008 50pf;N750
G4 (YELLOW)		DD1550009 50pf;N1500	DD1550009 50pf;N1500

Table 1. Compensation Circuit Component Values:

Electrical Parts List

REF DESIG	VALUE	TYPE	SCC PART NO.
CAPACITORS			
C103, 505	40 pf; ±5%	Fixed ceramic	DD1540003
C104, 111, 508	10 pf; ±10%	Fixed ceramic	DD1610003
C109, 130, 131, 164, 242, 510	0.001 uf; ±20%	Fixed ceramic	DK1710203
C117, 129, 311, 316	2 pf; ±0.5 pf	Fixed ceramic	DD1102004
C123, 141, 143, 157, 170, 509	0.01 uf; ±20%	Fixed ceramic	DK1710301
C125	7 pf; ±1 pf	Fixed ceramic	DD1207003
C132, 184	160 pf; 10%	Fixed ceramic	DD1616101
C133, 135, 138, 171, 188, 191, 199	200 pf; ±10%	Fixed ceramic	DD1620103
C134, 136, 140, 145, 155, 158, 224	0.005 uf; ±20%	Fixed ceramic	DK1750201
C137, 309, 312, 506	82 pf; ±10%	Fixed ceramic	DD1682001
C139	1 pf; ±0.25 pf	Fixed ceramic	DD1001002
C142, 165	0.6 pf; ±0.25 pf	Fixed ceramic	DD1000601
C144	30 pf; ±5%	Fixed ceramic	DD1530001
C146, 147, 174, 175, 176, 177, 178, 179, 211, 215, 226	0.04 uf; ±20%	Fixed plastic	DF1740301
C153, 306, 308, 310, 315, 334, 336, 338, 339, 340, 341, 370, 375, 385, 386, 602, 603, 604, 605, 606, 859	0.01 uf; +100%-0	Fixed ceramic	DK1810301
C160	68 pf; ±10%	Fixed ceramic	DD1668001
C167	3 pf; ±0.5%	Fixed ceramic	DD1103001
C172	60 pf; ±5%	Fixed ceramic	DD1560001
C173, 304, 314, 703	51 pf; ±10%	Fixed mica	DF3651001
C180, 181, 182, 183, 185, 362	0.03 uf; ±20%	Fixed plastic	DF1733301
C190, 194, 196, 360, 365	0.1 uf; ±20%	Fixed plastic	DF1710401
C192	10 pf; ±1 pf	Fixed ceramic	DD1210004
C193, 208, 209, 210, 213, 216 229, 230, 352, 702, 707	0.01 uf; ±20%	Fixed plastic	DF1710301
C195, 197, 223	47 uf; 16 VDC	Fixed electrolytic	EA4760169
C198	30 pf; ±5%	Fixed ceramic	DD1530101
C200, 217, 337, 357, 358, 359 369, 373	10 uf; 16 VDC	Fixed electrolytic	EA1060169
C201, 202, 203	0.0047 uf; ±20%	Fixed plastic	DF1747201
C204	0.33 uf; 25 VDC	Fixed electrolytic	EW3340251
C206, 207	0.022 uf; ±20%	Fixed plastic	DF1722301
C214, 332	0.001 uf; ±20%	Fixed plastic	DF1710201
C218, 219, 251, 253	10 uf; 10 VDC	Fixed electrolytic	EV1060101
C222	0.003 uf; ±20%	Fixed ceramic	DK1730202
C225	33 uf; 25 VDC	Fixed electrolytic	EA3360259
C227	330 uf; 16 VDC	Fixed electrolytic	EA3370169
C228	470 uf; 16VDC	Fixed electrolytic	EA4770169
C241	0.8 pf; ±10%	Fixed ceramic	DD1600801
C243, 512	50 pf; ±10%	Fixed ceramic	DD1650001
C244	0.47 uf; 25 VDC	Fixed electrolytic	EV4740251

Electrical Parts List

REF DESIG	VALUE	TYPE	SCC PART NO.
C252, 367	33 uf; 3 VDC	Fixed electrolytic	EV3360031
C305, 376, 384	50 pf; ±5%	Fixed ceramic	DD1550001
C307	120 pf; ±5%	Fixed ceramic	DD1512101
C313	140 pf; ±10%	Fixed ceramic	DD1614101
C317	39 pf; 10%	Fixed mica	DF3639001
C318, 371	470 pf; ±10%	Fixed ceramic	DK1647101
C319	35 pf; ±5%	Fixed ceramic	DD1535001
C320, 325	0.001 uf; ±20%	Fixed ceramic	DD1710201
C321	5 pf; ±0.5 pf	Fixed ceramic	DD1105002
C322	20 pf; ±10%	Fixed mica	DF3620002
C323, 349, 404, 405, 406, 507, 701	20 pf; ±5%	Fixed ceramic	DD1520001
C335	1 pf; ±0.25 pf	Fixed ceramic	DD1001001
C345, 347, 348, 361, 364	0.003 uf; ±20%	Fixed ceramic	DK1730202
C346	4.7 uf; 3 VDC	Fixed electrolytic	EA4750359
C350, 368	4.7 uf; 16 VDC	Fixed electrolytic	EV4750161
C351, 356	33 uf; 10 VDC	Fixed electrolytic	EA3360109
C363	0.22 uf; 25 VDC	Fixed electrolytic	EW2240251
C366	0.022 uf; ±10%	Fixed plastic	DF1622301
C401, 402, 407, 451, 501, 502, 503, 504, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843	0-20 pf	Variable ceramic	CT1200002
CAPACITORS			
C408, 409, 410, 452, 453	10 pf; ±1 pf	Fixed ceramic	DD1210006
C601	470 uf; 25 VDC	Fixed electrolytic	EA4770259
C704	200 pf; ±10%	Fixed mica	DF3620102
C705	100 pf; ±10%	Fixed mica	DF3610102
C706, 708	10 pf; ±10%	Fixed mica	DF3610001
C709, 710, 711, 712, 713, 714	7 pf; ±10%	Fixed mica	DF3607001
C715	5 pf; ±10%	Fixed mica	DF3605001
C716, 862, 863, 864, 865	2 pf; ±10%	Fixed mica	DF3602001
C844, 845, 846, 847, 848, 849 850, 851, 852, 853, 854, 861	30 pf; ±10%	Fixed mica	DF3630002
C855	120 pf; ±10%	Fixed mica	DF3612102
C856, 860	5 pf; ±1 pf	Fixed ceramic	DD1205005
C857, 858	50 pf; ±5%	Fixed ceramic	DD1550008
C951, 952, 953	0-6 pf	Variable ceramic	CT1060001
DIODES			
D103, 104, 105, 106, 109, 110, 302		Germanium	HD1000101
D107		7-volt zener	HD3001909
D108, 303, 304		Silicon	HD2001105
D111		Silicon	HV0000605
D301		9-volt zener	HD3001709
D601		Silicon	HD2000205
D602		Silicon	HD2000110

Electrical Parts List

REF DESIG	VALUE	TYPE	SCC PART NO.
INDUCTORS			
L102, 106		RF	LA1202601
L103		RF	LA1202606
L107		11.7 MHz IF	L11018604
L108		11.7 MHz IF	L11018607
L109		11.7 MHz IF	L11018608
L110		11.7 MHz IF	L11018605
L111		11.7 MHz IF	L11018606
L112		First tripler	LA1018603
L113		First tripler	LA1018604
L114		Second tripler	LA1018601
L115		Second tripler	LA1018609
L116		Discriminator	L11001045
L117		Discriminator	L11001046
L118, 119, 120, 121		Choke	LC1394001
L301		RF	LA7003003
L302, 303		First tripler	LW7008001
L304, 305		Second tripler	LW7008002
L306, 307, 309, 312, 313, 314, 315	0.04 uH	RF	LC1400001
L310		RF	LC1280001
L316		Directional	LF5008001
L317	6.38 uH	Choke	LC1381001
L318, 319	22 uH	Choke	LC2226001
L451	0.6 uH	RF	LC1600001
L501		RF	
L502		RF bifilter	
L503		RF bifilter	
L901		Helical resonator	
L902		Helical resonator	
L903		Helical resonator	
TRANSISTORS			
Q101		FET	HF2001910
Q103		MOSFET	HF9000110
Q104, 115		NPN – Silicon	HT305351B
Q105, 106, 107, 109, 110, 111 112, 113, 114, 116, 117		NPN – Silicon	HT800031B
Q119, 123		NPN – Silicon	HT306441B
Q120		PNP – Silicon	HT600011E
Q121, 122		NPN – Silicon	HT304862B
Q302, 303, 304, 400, 401, 402 403, 404, 701, 801		NPN – Silicon	HT800033A
Q305		NPN – Silicon	HT800032C
Q306		NPN – Silicon	HT3089100
Q307		NPN – Silicon	HT3073010
Q501		NPN – Silicon	HT3070310
Q502		NPN – Silicon	HT3070410
Q901		NPN – Silicon	HT8000410

Electrical Parts List

REF DESIG	VALUE	TYPE	SCC PART NO.
MISCELLANEOUS			
F101	455 kHz	Ceramic filter	FF1004507
F601	6 ampere	Fuse	FS1060001
G801		Temperature module	BF1000001
M602	12-volt	Lamp	IN1012103
M603	8-volt	Lamp	IN1008027
R167	200 ohms	variable composition	RA0201001
R169, 901, 902	150 ohms; ±10% 1/2 watt	Fixed composition	RC1015112
R186	2 ohms; ±10%; 1/2 watt	Fixed composition	RC1002012
R256	1000 ohms; ±10%; 1/8 watt	Fixed composition	RC1010218
R322	500 ohms	Variable composition	RA0501002
R325	75 ohms; ±10% 1/2 watt	Fixed composition	RC1075012
R351	2000 ohms	Variable Composition	RA0202001
R601	10,000 ohms (with switch)	Variable composition	RK1103008
R602	5000 ohms;	Variable composition	RK0502003
R903	50 ohms; ±10% 1/2 watt	Fixed composition	RC1050012
S301	12-volt	Relay	LY2012001
S601		Toggle switch	SC0202000
S801		12-position switch	SR0315001
T101		Input transformer	T11241101
T102		Output transformer	T01350603
X101	11.6925 MHz	Quartz crystal	XW2116925
X102	11.7075 MHz	Quartz crystal	XW2117075
X103	12.155 MHz	Quartz crystal	XA1121550

NOTE: All Resistors not listed are Fixed Composition, ±10%, 1/4 watt.